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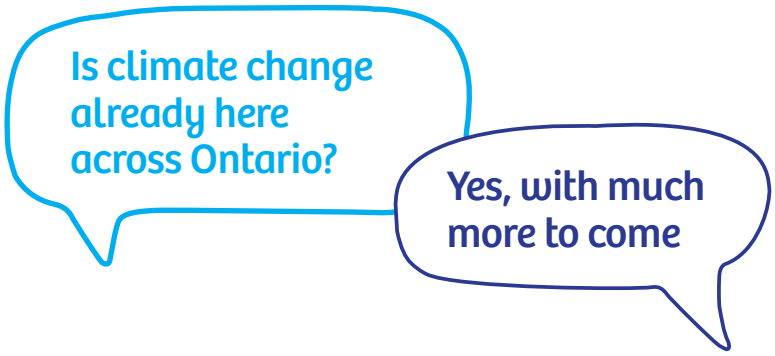
Chapter 9
Climate Change Impacts in Ontario

Abstract

Here in Ontario we are already feeling the effects of climate change. Higher average temperatures, more climate extremes and the increased incidence of drought, storms, and unseasonable temperatures are affecting people across the province.



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9.0 Health

Ontarians' health is already being affected by climate change. Hotter summer weather, especially when combined with the urban heat island effect, is particularly dangerous for elderly people, children, people who are marginally housed or homeless, and those with pre-existing health conditions, all of whom are more at risk of heat-related illness.

According to Toronto's Medical Officer of Health,

> *Extreme heat is associated with health impacts ranging from heat stress to heat stroke and death. Those most vulnerable to heat include isolated seniors, people with chronic and pre-existing illnesses, children, and people who are marginally housed or homeless. In Toronto, in addition to those who are homeless or underhoused, people who live in older apartment buildings may be at particular risk from heat. The majority of these buildings are not air conditioned, many are home to low income families and newcomers, and more than half of residents surveyed say that they experience symptoms of heat-related illness.*[1]

Tropical nights (defined as those with a minimum temperature over 20°C) make it harder to sleep without air conditioning, exacerbating social inequalities. Children and teachers may struggle in hot portable classrooms in June and September. Other public facilities, such as public transit, are also increasingly uncomfortable without air conditioning. Vulnerable people can also be among those most affected when extreme weather events disrupt electricity service.

These heat-related impacts will grow in the much hotter summers ahead of us.

Shifting Distribution of Temperature Anomalies: Northern Hemisphere Land, June–July–August

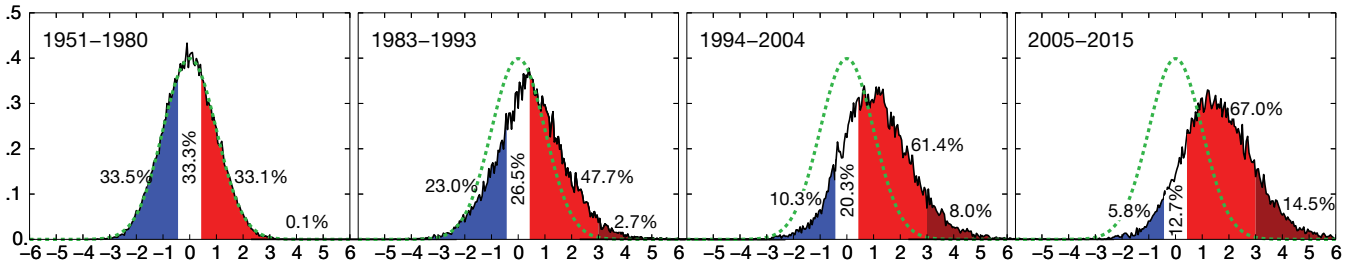

Figure 9.1. Shifting distribution of summer temperature anomalies in the northern hemisphere.

Source: NASA Goddard Institute for Space Studies and Columbia University Earth Institute, *Public Perception of Climate Change and the New Climate Dice*, 2016.

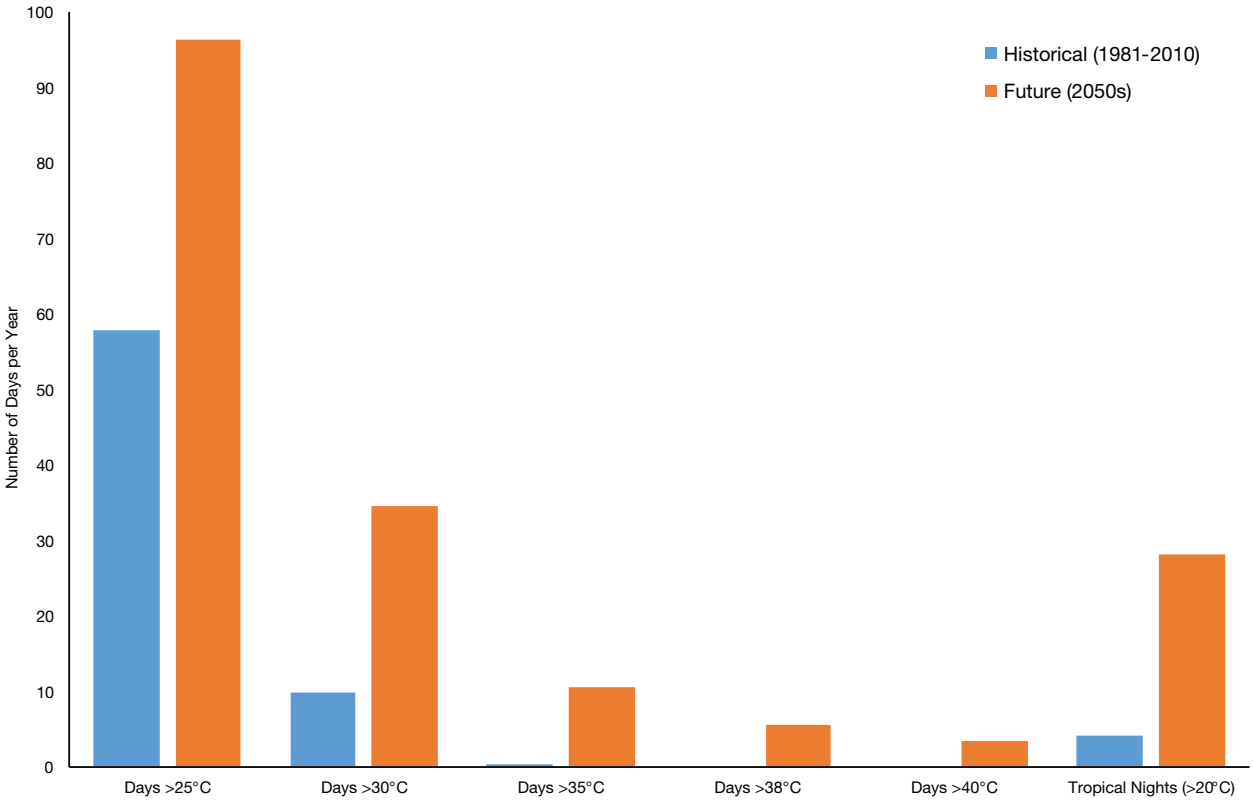

Figure 9.2. Extreme Heat Climate Indices in York Region, using Canadian Gridded Station Observation, CANGRD (Historical) and Ministry of the Environment and Climate Change (MOECC) Ensemble Median Values (Future).

Source: Fausto et al., *Historical and Future Climate Trends in York Region* (Toronto: Ontario Climate Consortium, 2015).

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The warming climate is helping vector-borne diseases to spread. 2017 was a record year for ticks in Ontario, which carry illnesses like Lyme disease and anaplasma. Other diseases currently confined to warmer climates, like the Zika virus, may one day reach Ontario as a result of warmer and wetter conditions in the province.

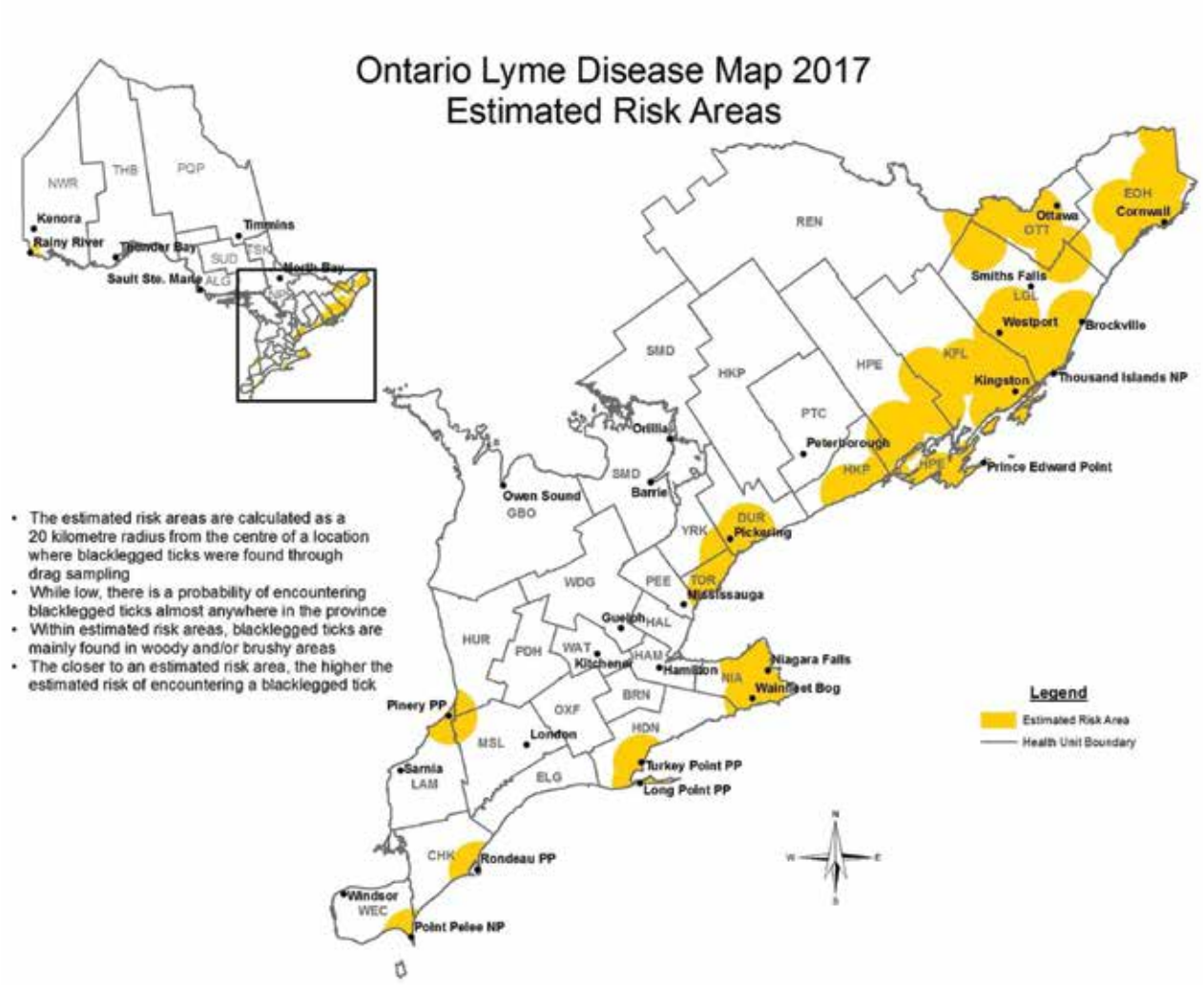

Figure 9.3. Ontario Lyme Disease Map 2017 – Estimated Risk Areas.

Source: Ontario Agency for Health Protection and Promotion (Public Health Ontario), *Ontario Lyme Disease Estimated Risk Areas Map* (Toronto: Queen's Printer for Ontario, 2017). Note: This document was adapted with the permission of Public Health Ontario. Public Health Ontario assumes no responsibility for the content of any publication resulting from translation/changes/adaptation of PHO documents by third parties.

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Hotter temperatures intensify the impacts from air pollution. They cause spikes in the concentration of some key pollutants (e.g., ozone and secondary particulate matter) by accelerating the reactions that form them. These pollutants can affect human lungs, causing:

- Shortness of breath;
- Painful breathing;
- Coughing;
- Throat irritation and respiratory tract inflammation; and
- Aggravation of pre-existing conditions, such as asthma and bronchitis.

The formation of ground-level ozone requires three key ingredients: nitrogen oxides (NO_x), volatile organic compounds (VOC), and sunlight. Because heat plays a role in increasing concentrations of ground-level ozone, outdoor air quality can be expected to worsen with high temperatures, especially on hot summer days without clouds.

Toronto's Medical Officer of Health reports that air pollution, primarily from motor vehicle traffic, contributes to 1,300 premature deaths and 3,550 hospitalizations in Toronto each year.[2] According to the Medical Officer of Health,

> *People living close to roads are more likely to experience adverse health outcomes including breathing problems, heart disease, cancer and premature death.*[3]

The health risk from traffic-related air pollution is highly localized, and therefore can be reduced by local action to minimize the use of internal combustion engines, which would also help reduce greenhouse gas emissions:

> *Emissions of traffic-related air pollution … can be reduced with sustained focus on initiatives that promote active transportation and transit, reduce congestion, and encourage use of electric vehicles.*[4]

For comparison, the C40 Cities Climate Leadership Group estimates that Paris's *Green & Healthy Streets Declaration* (a commitment to close the city to fossil fuel vehicles by 2030 and to procure only electric buses by 2025) will:

- Avoid an estimated 400 air quality related deaths per year;
- Add 21 days to average life expectancy for every resident of Paris; and
- Prevent an estimated 1,280 respiratory hospital admissions and 6,350 cardiovascular hospital admissions annually.[5]

In 2017, heat, droughts and wildfires, worsened by climate change, caused an unrelenting increase in dangerous spikes in particle pollution from dust and smoke in a number of American cities. More than 4 in 10 people suffered from poor air quality in these communities.[6] Similar air quality impacts occurred in parts of western Canada, as British Columbia experienced its worst wildfire season on record. Ontario is equally susceptible to pollution from wildfires – see Section 9.1.

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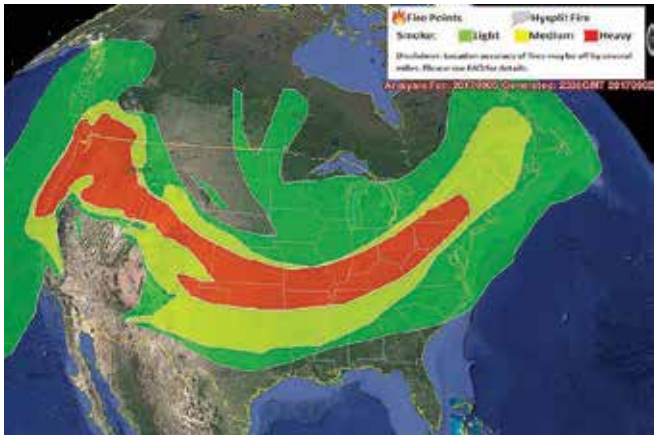
9.1 Forests

In 2016, the ECO reported on the risk of catastrophic fires in Ontario's forests. Even in the comparatively mild wet summer of 2017, more than 155 wild fires burned in northwestern Ontario. Despite expected increases in rainfall events, the overall trend toward warmer summers and longer periods of warm weather will bring a growing risk of wildfires in the province. Climate change also means more sudden, heavy rainfalls that result in runoff or evaporation, because the soil cannot absorb all the water; between rainfall events, forests continue to dry out. As illustrated by catastrophic fires in Canada, Chile, Portugal, California and elsewhere around the world in 2017, the growing risk of forest fires has significant environmental, health and social consequences for Ontario communities.



Smoke from the 2017 California forest fires affected large areas of North America, including Ontario.

Photo credit: U.S. National Oceanic and Atmospheric Administration.

A warmer climate also carries with it an increased risk of pest epidemics and diseases in Ontario's forests. For instance, climate change is expected to result in increased Spruce Budworm damage in northern areas of Ontario and decreased Spruce Budworm damage in more southerly areas. Changes in composition and productivity of forests will result in shifts to the distribution and abundance of many species, and could cause the local disappearance of vulnerable species due to less favourable conditions.

Increased disturbances as a result of climate change could have an impact on the carbon storage potential of Ontario's forests (see Chapter 4 of this report for discussion of forest carbon and Ontario's proposed offset program). Together with socio-economic impacts to the forest industry and those who rely on it, climate change is likely to have a significant cumulative effect on Ontario's forests.

9.2 Warmer Winters

Warmer winters are having an impact across the province.

Unseasonably warm temperatures are threatening the viability of ice roads in the north, which could weaken a lifeline to dozens of remote First Nation communities. From 2017 to 2018, the province is investing $5.8 million to build and maintain winter roads.[7] Overall, the cost of maintaining all-weather roads is likely to be much higher in years to come.

The thinning and loss of sea and lake ice has many impacts, including on the food web. Shorter, less reliable winters can affect First Nations' travel to hunting grounds as well as animal habitat, and can make it harder for northern communities to obtain and to preserve wild sources of food. For waterfront communities, loss of ice can exacerbate erosion, affecting safety and the habitability of some areas. Winter thaws and rain-on-snow events can damage vegetation, and create adverse conditions for grazing animals such as caribou.

As climate change continues, melting permafrost in Ontario's northern communities is expected to have a significant effect on other infrastructure. Arctic Council research suggests that 20% of the top layer of permafrost could melt by 2040.[8] This could warp roads and sink buildings, leading to the displacement of entire communities. Melting permafrost may also unlock significant amounts of methane into the atmosphere, further exacerbating climate change.

Farther south, warmer winters complicate winter maintenance of roads and other infrastructure. With more fluctuations above and below the freezing point, more salt is being used, increasing salt infiltration into aquifers. This is a particular concern in areas of the province that depend on groundwater for drinking, such as Waterloo Region. The ECO has also heard reports of more damage occurring to infrastructure, such as concrete spalling (cracking) in Thunder Bay where winter weather used to stay reliably below freezing.

Warmer winters are also altering economically important recreational activities in communities across the province. Less predictable snow cover hurts snow-based tourism. On Lake Simcoe, the season for ice fishing has decreased by one day each year since 1989.[9]

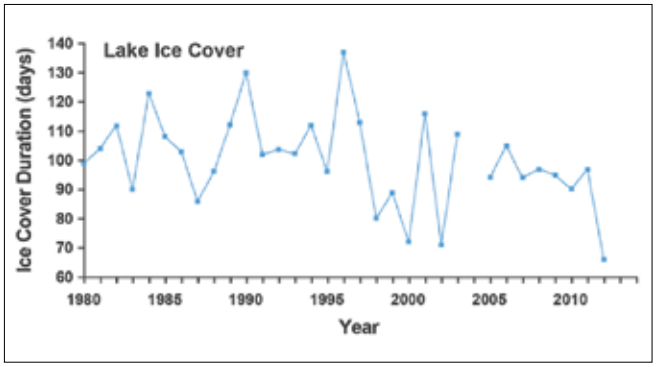


Figure 9.4. Decrease in duration of ice cover in Lake Simcoe from 1980-2012, as observed from Barrie.

Source: Government of Ontario, Minister's *Five Year Report on Lake Simcoe: To protect and restore the ecological health of the Lake Simcoe watershed*.

Photo credit: Ministry of Natural Resources and Forestry.

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Photo credit: Queen's Printer for Ontario.

The Rideau Canal Skateway, which has been dubbed the world's largest skating rink, has been affected by variable temperatures and shorter winter seasons. In 2016, the skateway was open for 18 days, whereas typically, it would remain open from early January to March. In fact, in 1971-1972, the skating season was 90 days long. The skateway is economically and culturally important; it is estimated to bring in about a million visitors each year, and has become an iconic symbol of Canada's capital.

9.3 Agriculture and Food

Ontario's summers are getting hotter, and the hot weather is lasting longer as the climate heats up.[10] This has significant implications for many sectors, including agriculture, forestry, and buildings.

Ontario's frost-free season is already increasing by 1-13 days each decade in areas across the province.[11] Different regions are warming at different rates. For instance, the Greater Toronto Area's frost-free season has increased by 3-4 days per decade over the past 36 years.[12] The frost-free season in northern portions of the province is increasing even faster: some areas have experienced increases of more than 10 days per decade over the same study period.[13] In 2016, Thunder Bay saw the longest streak of frost-free days in recorded history, with a record 140 consecutive days without frost. Over the past decade, the frost-free season in Thunder Bay was closer to 99 days.

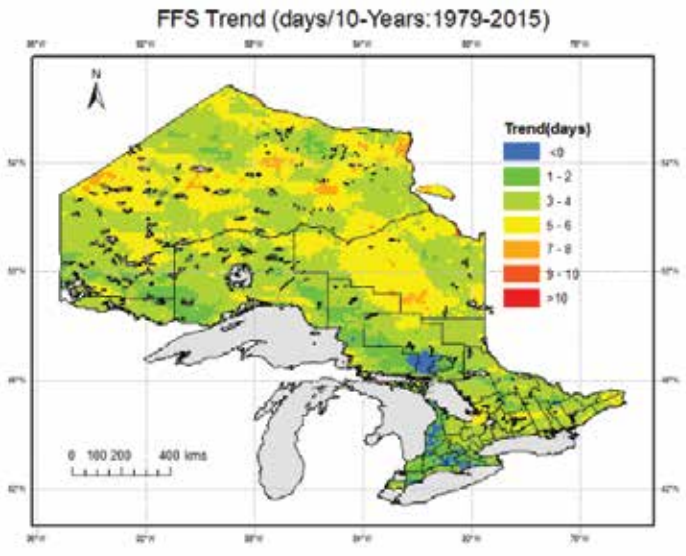

Figure 9.5. Frost-free season trend showing increase in frost-free days over a 10-year period.

Source: Laboratory of Mathematical Parallel Systems (LAMPS), York University.

Photo credit: Shutterstock.

Longer growing seasons can help agriculture, but unpredictability and invasive pests can be very hard on farmers. Wetter springs and faster melts have been coupled with increased summer drought,[14] such as that experienced in 2016 across much of Ontario. Some of the regions hardest hit by droughts in 2016 were also damaged by heavy rains and flooding in the summer of 2017. A rainy spring delayed the planting of crops throughout many parts of the province, and wetter than normal conditions throughout the 2017 summer months led some farmers to lose hundreds of acres of crops.

Warmer winters can also cause challenges for specialty crops, such as the award-winning ice wine grapes in Ontario's wine growing regions. These grapes need a temperature of -8°C to be used for ice wine: grapes freeze at this temperature and can be used to produce sufficiently concentrated juice, which is what distinguishes an ice wine from other wine types. The unpredictable and fluctuating weather experienced in the past several winters has wreaked havoc.

Flooding in Foxboro, Ontario. Photo credit: Associated Press.

9.4 Storms and Flooding

Increased extremes in temperature and precipitation also mean increased risk of flooding in communities across the province. Overall, a warmer climate is expected to lead to increased localized rainfalls and extreme storms,[15] which could have particularly serious consequences in urban areas. The Toronto floods in 2013, the 2014 floods in Burlington and parts of eastern Ontario, and those experienced on the Toronto Islands, in Windsor, in Cambridge, in Minden and in the Ottawa-Gatineau region in 2017, are all the types of events that climate change makes more likely.

The socio-economic costs of these floods are significant: for example, the 2013 flooding that affected portions of Toronto resulted in more than $940 million in damages.[16] While official figures are not yet available for the floods that occurred in 2017, the number is likely to be in the tens of millions, if not higher.[17]

9.5 Conclusion

Climate change isn't just about polar bears, or about other people in other places in the future. Ontario is already feeling the first effects of climate change, and much bigger changes are ahead.

Endnotes

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